

The difficulties we encounter during the experiment of quadratic programming are the cycling problems and the long computation time. First of all, cycling problems are caused by CPLEX's algorithm. CPLEX uses branch and cut algorithm to solve quadratic objectives. Branch and cut algorithm is a combination of the branch and bound algorithm and cutting planes. Branch and bound algorithm is a balanced binary tree that starts from a root node and branched by the unknown variables' upper-bound and lower-bound. In our model, lower-bound is the lowest energy cost of an edge, and upper-bound is the maximum energy cost of an edge. By default, CPLEX itself will decide which direction to search to find the optimal result. However, according to the data resilience level's formulation, the energy costs of the nodes that do not store data are ignored. If CPLEX decides to search from maximum energy cost which is the upper-bound of the tree, nodes that do not store data may spend extra energy and cause looping problems. To solve this problem, we can either do some manual calculation to eliminate the loops or force the algorithm to search from lower-bound first. However, the computation time and memory will increase significantly and cause memory problems since the optimal solution may not be at the lower-bound branch. Another problem we encounter is the long computation time to reach the optimal solution. Since the computation time depends on the unknown variables in the model, large variables will increase the computation time and memory requirement. In our model, we have an average of 1500 edges and each edge represents an unknown variable. In addition, according to the algorithm, we may have $2^{1500} - 1$ nodes to traversal. Thus, the computation may sometimes cause memory issues and long computation time.